PTITSYN G A.

KOKICHEV, V.N.; PTITSYN, G.A.; SHAVLYUGA, N.I., kandidat tekhnicheskikh
nauk, dotsent, redaktor; DLUGOKANSKAYA, Ye.A., tekhnicheskiy redaktor

[Gear-cutting machines; reference manual] Zuboreznye stanki;
spravochnoe posobie. Moskva, Gos. nauchno-tekhn. izd-vo mashino-
stroitel'noi lit-ry, 1954. 355 p.   (MIRA 8:4)
      (Gear-cutting machines)

PTITSYN   G.A.

PRINTSENTAL', S.G.; PTITSYN, G.A.; PETRUSEVICH, A.I., doktor tekhniche-
skikh nauk, retsenzent; LITVIN, F.L., kandidat tekhnicheskikh nauk,
retsenzent; KORICHEV, V.N., inzhener, redaktor; POL'SKAYA, R.G.,
tekhnicheskiy redaktor

[Technology of turbine reduction gear production] Tekhnologiia
proizvodstva turbinnykh reduktorov. Moskva, Gos. nauchno-tekhn.
izd-vo mashinostroit. lit-ry, 1953. 303 p. [Microfilm]
                                                (MLRA 7:10)
        (Turbines)   (Gearing)

PTITSYN, G. V.

Elektrooborudovanie motorvanonnogo podvizhnogo sostava na dva npriakeniia. /Electic equipment for the rolling stock of motor train operated on two voltages_/. Moskva, Gos. transp. zhel-dor. izd-vo, 1949. 167 p. diag-s.

DLC: TF920P8

SO: Soviet Transportation and Communications, A Bibliography, Library of Congress, Reference Department, Washington, 1952, Unclassified.

PTITSYN, G.V., inzhener; BELKIN, I.I., inzhener.

Automatic control system for RVZ-55 streetcars with mixed excitation electric motors. Vest. elektroprom. 28 no.3:59-62 Mr '57.

(MIRA 10:4)

1. Zavod "Dinamo".
   (Electric railway motors)   (Automatic control)

PTITSYN, G. V.

Equipment of electric locomotives with a low and high tension system Moskva, Gos. transp. zheldor. izd-vo, 1949. 167 p. (50-18036)

TF920.P8

PTITSYN, I.Ya.

Outstanding sections of the Moscow Highway Department. Avt.
dor. 22 no.1:19-21 Ja '59.   (MIRA 12:2)

1. Nachal'nik Ushosdora Moskovskoy oblasti.
        (Moscow--Roads--Maintenance and repair)

L 23829-65   EWT(1)/EWG(k)/EWT(m)/EPA(sp)-2/EPF(c)/EPF(n)-2/ EWT(1)-2/ IJP(c)   JD/WW/
T/EWP(t)/EWA/EWP(b)/EWA(m)-2   PK-6/Pab-10/Pr-4/Pad/Pu-4   IJP(c)   JD/WW/
HW/JG/AT

AUTHOR: Chaykovskiy, E.F.; Ptitsyn, G.V.

TITLE: Use of the effect of positive surface ionization for investigating cathode sputtering of metals

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.12, 1964, 2194-2196

TOPIC TAGS: cathode sputtering, surface ionization, platinum, nickel

ABSTRACT: One of the experimental problems encountered in studying cathode sputtering is that of obtaining ion beams of different intensity, but in each case monoenergetic and incident at a definite angle. In the present work to obtain the requisite beams there was used the phenomenon of positive surface ionization. The positive potassium ions thus produced were employed to investigate sputtering of platinum and nickel. The measurements were carried out by means of equipment previously used to study positive surface ionization and diagramed in Fig.1 of the Enclosure. The emitter and collector were made of platinum and nickel ribbon and measured 0.002 x 0.4 x 1.25 cm. The spacing between them was 0.03 to 0.04 cm. A potential of from 100 to 500 V was maintained between the emitter and collector.

1/4

L 23829-65

ACCESSION NR: AP5000849

In preliminary measurements there was determined the dependence of the sputtering coefficient (yield in terms of atoms per ion) on the density of the ion beam; it was found that this dependence is nil, which indicates that the preheated, bombarded surfaces were clean. Then there were obtained the ion energy dependences of the sputtering coefficient. The results are shown in Fig.2 of the Enclosure. It will be evident that in the investigated energy range (100 to 500 V) the dependences are linear. Orig.art.has: 1 formula and 2 figures.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut monokristallov, Khar'-kov (All-Union Scientific Research Institute of Single Crystals)

SUBMITTED: 19May64   ENCL: 01

NR REF SOV: 003   OTHER: 004   SUB CODE: EM, EC

2/3

L 35502-65   EWT(1)/EWT(m)/EPF(c)/EWA(d)/EPA(w)-2/EEC(t)/T/EWA(m)-2   Pab-10/Pr-4
ACCESSION NR: AP5007302   IJP(c)   WW/JW   S/0057/65/035/003/0528/0534

AUTHOR: Chaykovskiy, E. F.; Ptitsyn, G. V.

TITLE: Positive surface ionization of potassium on texturized ribbons of platinum

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 35, no. 3, 1965, 528-534

TOPIC TAGS: ionization, surface ionization, potassium surface ionization, surface
atom ionization, alkali metal surface ionization, positive surface ionization, sur-
face ionization coefficient

ABSTRACT: An experimental investigation was made to clarify the causes of discrep-
ancies in the results of earlier investigations concerning the positive surface
ionization of alkali metals on Pt. The experiment was arranged to minimize the
number of uncontrollable parameters. Potassium was selected because the Datza and
Taylor data on that element (J. Chem. Phys., v. 25, 1956, 389) deviated considerably
from the solutions of the Saha and Langmuir equation. The polycrystalline surfaces
tested in earlier experiments were replaced by wholly texturized platinum ribbon.
The surface of rolled and heat-treated ribbons was a mosaic of the (111) faces of
Pt crystals. Platinum plates 0.01 x 0.4 x 1.25 cm were used both as emitter and
collector, with a gap between them of 0.04 cm. The emitter and collector were
heated at 1600C for one hour with a subsequent short heating at 1700C. The vapor
Card 1/3

L 35502-65

ACCESSION NR: AP5007302

method of measurement was used. The temperature of the potassium evaporizer was kept 20—30C below the temperature of the other parts of the measuring device. The vacuum of the system was maintained at better than 1×10^{-6} mm Hg. The experiment established the dependence of ion current on the emitter temperature at various magnitudes of potassium vapor pressure, which was varied within a wide range yielding ion current densities from 30 μamp/cm^2 to 80 mamp/cm^2. The resulting curves show the typical form for positive surface ionization of easily ionizing elements. The hysteresis in the dependence of ion current on emitter temperature, which was pronounced at lower potassium vapor pressures, diminished as the pressure increased and disappeared completely at a certain critical pressure. The desorption heat of K$^+$ ions from Pt was 2.5 ± 0.2 ev. The ionization coefficient of K atoms at 1500K was found to be $90 \pm 5\%$, with the corresponding work function value of 4.8 ± 0.2, which is somewhat lower than the 5.3 ev derived from Richardson curves for polycrystalline platinum. The difference may be due to the use of a texturized surface in the experiment. An investigation was made of the cause for the substantially higher (25%) value of the ionization coefficient as compared to that obtained by Datza and Taylor. The assumption of a combination of Pt and K to form an intermetallic compound with a low work function was abandoned because experiments showed that no such reaction takes place. Greater significance is ascribed to atomization of the collector and the deposition of its material on the emitter. It was established experimentally that up to 400 monolayers per second may be deposited on the

Card 2/3

L 35502-65

ACCESSION NR: AP5007302

emitter. The deposits were found to retain their texture of (111) faces. The ionization coefficient dropped considerably when different materials were used for the collector and emitter. The low value of the ionization coefficient obtained in earlier experiments might be explained by the deposition of atomized foreign material on the emitter. Orig. art. has: 3 figures and 5 formulas.

[FP]

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut monokristallov (All-Union Scientific Research Institute of Single Crystals)

SUBMITTED: 19May64

ENCL: 00

NO REF SOV: 013

OTHER: 005

SUB CODE: SS,GC

ATD PRESS: 3215

Card 3/3 JO

BARANNIK, V.P., inzhener; ZENGIN, B.Ye., inzhener; PTITSYN, I.Ya.,
    inzhener.

    Experience in using potentialities in lowering the costs of
    major road repairs. Avt.dor. 18 no.2:24-25 Mr-Ap '55.
        (Roads--Maintenance and repair)   (MLRA 8:6)

PTITSYN, K.M.

A batcher-feeder for loose materials. Stal' 7 no.1:77 '47.
(Steel industry--Equipment and supplies)   (MLRA 9:1)

33147
S/120/61/000/006/015/041
E140/E435

9.4150 (1138, 1140)

AUTHORS: Bartenev, L.S., Glebovich, G.V., Ptitsin, K.N.

TITLE: Ultra-high-speed pulse oscillograph

PERIODICAL: Pribory i tekhnika eksperimenta, no.6, 1961, 80-83

TEXT: An ultra-high-speed oscillograph is described, reaching
time base velocities of 2×10^{10} cm/sec and time instability
$\sim 1.5 \times 10^{-11}$ sec, permitting registration of pulse processes
with durations of 10^{-10} sec.   The basic features of the system
are: the use of shock-waves generated in a ferrite transmission
line, as the time base, and a specially designed CRT.   The
latter employs a slotted coaxial line for the vertical deflection
and a special diaphragm (Fig.3).   The diaphragm cuts off the
beam in the resting position, eliminates an initial nonlinear
portion of the time base, and again cuts off the beam at the end
of the time base, permitting less stringent requirements on the
beam brightening pulse.   The use of complete supply voltage
stabilization and other design measures has permitted keeping the
time base instability within the limits described.   There are
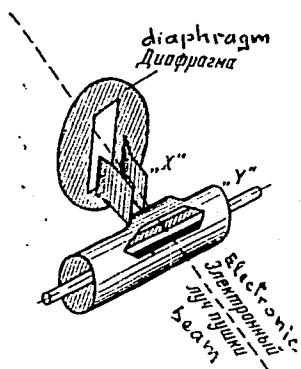4 figures and 2 Soviet-bloc references.

Card 1/2

Ultra-high-speed pulse oscillograph

33147
S/120/61/000/006/015/041
E140/E435

ASSOCIATION: Nauchno-issledovatel'skiy radiofizicheskiy institut
GGU (Scientific Research Radiophysics Institute GGU)

SUBMITTED: April 17, 1961

Fig.3.

diaphragm
Диофрагма

Card 2/2

L 64474-65 EWT(1)/EEC(k)-2/EED-2/EWA(h) WW

ACCESSION NR: AR5006548 S/0274/64/000/012/A089/A089

621.317.755

SOURCE: Ref. zh. Radiotekhnika i elektrosvyaz' Sv. t., Abs. 12A506

AUTHOR: Bartenev, L. S.; Glebovich, G. V.; Ptitsyn, K. N.

TITLE: Peculiarities in the development of a superhigh-speed oscillograph

CITED SOURCE: Tr. po radiotekhn. elektrotekh. i energ. Gor'kovsk. politekh. in-t, no. 2, 1964, 40-47

TOPIC TAGS: electronic oscillograph, superhigh speed oscillograph

TRANSLATION: Methods are suggested for overcoming the fundamental difficulties in the oscillograph development. A ferrite-type line is used for shaping the sweep voltage; a diaphragm under the second-anode potential and passing the beam only to the working part of the screen is used for precluding screen blurring. Cable and deflecting-system types which reduce distortion to a minimum are suggested. Inclusion, in the signal circuit, of a telescopic coaxial delay line calibrated in the fractions of nanosecond is suggested for the purposes of calibrating the duration of test pulses. Instability of operation is analyzed,

Card 1/2

L 64474-65

ACCESSION NR: AR5006548

minimum duration of test pulses is calculated, and the principal circuit of a laboratory model is presented. Bibliography: 6 titles.

SUB CODE: EC   ENCL: 00

Card 2/2

SOV-109-3-4-18/28

AUTHORS:Glebovich, G. V., Gryaznov, M. I. and Ptitsyn. K. N.

TITLE: Investigation of Certain Circuits used in the Generation of
         Short Pulses (Issledovaniye nekotorykh skhem formirovaniya
         korotkikh impul'sov)

PERIODICAL: Radiotekhnika i Elektronika, 1958, Vol 3, Nr 4,
         pp 562-566 (USSR)

ABSTRACT: It is pointed out that very short video pulses can be
         generated either by means of a delay line fitted with a
         mercury relay or by means of a delay line and a fast thyra-
         tron. The relay-type pulse generator can produce pulses
         with rise times of the order of 1 mμ s and amplitudes of up
         to 120 V. Thyratrons can be used either with a capacitor
         in the anode (Fig.1) or with 2 delay lines (Fig.4). The
         capacitor type generator produces triangular pulses (Fig.5a)
         while the delay line circuit can generate almost rectangular
         pulses. It was found that the thyratron generators produce
         pulses with rise times of the order of 5 mμ s. The paper
         contains 6 figures and 1 English reference.

SUBMITTED: June 20, 1956

         1. Video pulses   2. Pulse generators--Equipment
Card 1/1

P T I T S Y N   K.N.

GLEBOVICH, G.V.; GRYAZNOV, M.I.; PTITSYN, K.N.

Investigating some short-pulse circuits. Radiotekh. i elektron.
3 no.4:562-566 Ap '58.   (MIRA 11:4)
                    (Pulse techniques (Electronics))

BUKSHTEIN, Moisey Solo........... ....ed.;
CHERTOV, A.S.; red.; CHUVIKOV, N.T., dots.; red.;
BLAGOV, V.F.; red.; PTITSYN, K.N., red.

[Album of drawings for detailed work in electrical and
radio engineering] Al'bom chertezhei dlia detalirovok
po elektrotekhnike i radioelektronike. Moskva, Energiia
1964.   diagrs.   (MIRA 18:1)

1. Starshiy prepodavatel' radiotekhnicheskikh kafedr
Gor'kovskogo politekhnicheskogo instituta (for Blagov,
Ptitsyn).

GUBENKO,A.B., doktor tekhnicheskikh nauk, laureat Stalinskoy premii;
    ZUBAREV,G.N., inzhener; PTITSYN,N.P., inzhener, laureat
    Stalinskoy premii

Metal and wooden arches and beams made of factory-produced
standard glued blocks. Rats. i izobr. predl. v stroi. no.101:
14-18 '55.   (MIRA 8:10)

1. TSentral'nyy Nauchno-issledovatel'skiy institut promyshlen-
nykh sooruzheniy (for Zubarev)
                    (Girders) (Arches)

PTITSYNA, O.A.; LYATIYEV, G.G.; REUTOV, O.A.

Reaction of diphenyliodonium fluoboride with aliphatic amines.
Dokl. AN SSSR 157 no. 2:364-366 Jl '64.   (MIRA 17:7)

1. Moskovskiy gosudarstvennyy universitet imer'. M.V. Lomonosova.
2. Chlen-korrespondent AN SSSR (for Reutov).

L 26573-66   EWT(m)/EWP(j)   RM/WW

ACC NR: AP6016976   SOURCE CODE: UR/0020/65/165/003/0582/0585

AUTHOR: Ptitsyna, O. A.; Pudeyeva, M. Ye.; Reutov, O. A. (Academician)

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet

TITLE: Reactions between triphenylphosphine and fluoborides of nonsymmetrical diaryliodium salts

SOURCE: AN SSSR. Doklady, v. 165, no. 3, 1965, 582-585

TOPIC TAGS: chromatography, organic phosphorus compound, photochemistry, boron compound, fluorinated organic compound

ABSTRACT: Fluoborides of nonsymmetrical diarliodonium salts: m-nitrophenyl-phenyliodonium, p-anisylphenyliodonium, p-anisyl-m-nitrophenyliodonium, m-carbethoxyphenyl-phenyliodonium, o-nitrophenyl-phenyliodonium, and p-chlorophenyl-phenyliodonium salts, were reacted with triphenylphosphine in acetone for six to eight hours at 1:1 ratios of the initial reagents. After the reaction, the acetone was evaporated, and the residue repeatedly washed with ether to remove aryl iodides and unreacted triphenylphosphine. Then the tetraarylphosphonium fluoborides were separated from the diaryliodonium fluoboride by thin-layer chromatography. A substantial influence of polar factors was observed in the photochemical reaction between diaryliodonium fluoborides and triphenyl-phosphine: in most cases phosphonium salts were obtained only with the more electron acceptor substituent. Only in the decomposition of the p-chlorophenyl-phenyliodonium salt, in which the radicals are close in electronegativity, are the phosphonium salts obtained in almost equivalent amounts. The data obtained

Card 1/2

L 26573-66

ACC NR: AP6016976

are in good agreement with the previously proposed chain radical mechanism. The thermal reaction between triphenylphosphine and ArAr'IBF$_4$ (m-nitrophenyl-phenyliodonium, p-anisyl-phenyliodonium, p-anisyl-m-nitrophenyliodonium, and m-carboxyphenyl-phenyliodonium fluoborides) was investigated for comparison (heating at 97° in darkness for 10 hours in the presence of n-propanol). The data of the thermal reaction and those of the photochemical reaction between triphenylphosphine and diaryliodonium salts are practically the same. In both cases the radical with more electron-acceptor substituent is predominantly (or exclusively) transferred to triphenylphosphine. Orig. art. has: 2 tables. [JPRS]

SUB CODE: 07 / SUBM DATE: 15May65 / ORIG REF: 002 / OTH REF: 004

Card 2/2

GORCHAKOV, G.I., kand.tekhn.nauk; KAPKIN, N.M., kand.tekhn.nauk; PTITSYN,
    O.A., inzh.

    Cements and concretes recommended for severe conditions. Trudy
    NIIZHB no.22:64-92 '61.   (MIRA 14:10)

    1. Moskovskiy inzhenerno-stroitel'nyy institut im. V.V.Kuybysheva
    (for Gorchakov). 2. Nauchno-issledovatel'skiy institut betona i
    zhelezobetona Akademii stroitel'stva i arkhitektury SSSR (for
    Kapkin).
    (Hydraulic structures) (Cement--Testing) (Frost resistant concrete)

S/081/62/000/003/032/090
B149/B102

AUTHORS: Gorchakov, G. I., Kapkin, M. M., Ptitsyn, O. A.

TITLE: Cement and concrete types recommended for severe conditions

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 3, 1962, 391, abstract
              3K350 (Tr. N.-i. in-ta betona i zhelezobetona Akad. str-va i
              arkhitekt. SSSR, no. 22, 1961, 64 - 92)

TEXT: The results of lengthy investigations of the durability of con-
crete depending on its mineralogical and qualitative composition, the
addition of organic surface-active substances, its water/cement ratio,
the period of preliminary hardening under normal conditions and on
steaming, -are given. During a cold period, samples situated in a sea
water zone of changing level were subjected to two cycles of freezing-
thawing every 24 hours. The result of the long term investigation showed
that the main cause of quick deterioration of concrete under severe con-
ditions was: its inadequate compactness, non-uniformity of its structure
(faulty seams and cracks formed at the time of laying and hardening due
to neglect of correct production methods. Advice is given concerning the

Card 1/2

Cement and concrete types...   S/081/62/000/003/052/090
                                                3149/B102

choice of materials and methods of construction. The wide use of pre-
fabricated constructions with water/cement ratio 0.3 - 0.4 is recommended
for the external parts of hydrotechnical structures subjected to repeated
freezing. [Abstracter's note: Complete translation]

Card 2/2

BIRSHTEYN, T.M.; PTITSYN, O.B.

Stereospecific effect of the end of a growing chain in the polymerization of charged monomers. Vysokom.soed. 6 no.2:224-226 F '64.

(MIRA 17:2)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.

EYZNER, Yu.Ye.; PTITSYN, O.B.; PILIPOSYAN, A.G.

Hydrodynamics of polymer solutions. Part 6: Intrinsic viscosity
of partially penetrable flexible macromolecules in good solvents.
Vysokom.soed. 5 no.11:1711-1716 N '63.   (MIRA 17:1)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR i
Vychislitel'nyy TSentr AN Armyanskoy SSR.

NEKRASOVA, T.N.; ANUFRIYEVA, Ye.V.; YEL'YASHEVICH, A.M.; PTITSYN, O.B.

Potentiometric titration of polyacrylic, polymethacrylic, and poly-L-glutamic acids. Vysokom. soed. 7 no.5:913-921 My '65.
(MIRA 18:9)

1. Institut vysokomolekulyarnykh scyedineniy AN SSSR.

PTITSYN, O. B.

184T102

USSR/Physics - Polymers, Linear   1 Jun 51

"Geometry of Linear Polymers," M. V. Vol'kensh-
teyn, O. B. Ptitsyn.

"Dok Ak Nauk SSSR" Vol LXXVIII, No 4, pp 657-660

Present-day phys of linear polymers proceeds
from representation of familiar freedom of rota-
tion of members of the polymer chain. Up to now
no method has been described for solving prob-
lems of the geom of such chains. The most im-
portant formulas in the lit are given without
derivation. Here method is expounded which is
convenient for any potentials that brake int

USSR/Physics - Polymers, Linear   1 Jun 51
                    (Contd)

rotation. Also gives anal of existing computa-
tional formulas. Submitted 6 Apr 51 by Acad
A. F. Ioffe.

184T102

184T102

PTITSYN, O.B.

Effect of asymmetric additives on the lengths of chains of linear polymers. T. M. Birshtein and O. B. Ptitsyn (Inst. High Molec. Compds., Acad. Sci.). U.S.S.R. Zhur. Fiz. Khim. 29, 1216-17(1955).—Theoretical and math. The addn. of asymmetric substances to a linear polymer increases the bending of the chain and reduces the end-to-end distance of rotation isomers as given by Vol'kenshtein (cf. preceding abstract).   P. H. Rathmann

PTITSYN, O.B.

USSR.

539.133

3738. **Dimensions of the real chains of linear polymers in solutions.** M. V. VOL'KENSHTEIN AND O. B. PTITSYN. *Dokl. Akad. Nauk SSSR,* 86, No. 3, 493-6 (1952) *In Russian.*

A simple method is proposed for an approximate evaluation of the influence of the volume effects on the dimensions of the polymer molecules. The final formula shows that, when volume effects are taken into account, the value $\sqrt{h^2}$ (h being the probable chain length) varies as $N^{0.6}$ (not as $N^{0.5}$) and that its temperature dependence is less pronounced than was assumed previously.   *F. Zachman*

M. A. Voutz
2 copies

PTITSYN, O. B.

PA 252T91

USSR/Physics - Crystalline Polymers   1 Oct 52

"Rotational-Isomeric Theory of Fusion of Crystal-
line Polymers," M. V. Volkenshteyn and O. B.
Ptitsyn, Inst of High-Mol Compds

DAN SSSR, Vol 86, No 4, pp 677-680

Attempts to prove on basis of rotational isomeric
theory that the temp of cryst fusion and the
elasticity modulus should rise with increasing
stretching of the mol chain of the polymer. This
theory permits direct connection between phys
properties of polymers and their chem structure.
Presented by Acad A. F. Ioffe 28 Jul 52.

252T91

PTITYN, O. B.

Geometry of linear polymers. III. The degree of convolution and bending of polymer chains. M. V. Vol'kenshtein and O. B. Ptitsyn (Inst. High-Molecular Weight Compds., Acad. Sci. U.S.S.R., Leningrad). Zhur. Fiz. Khim. 27, 76-86(1953); cf. C.A. 46, 21f; 48, 13349d; 49, 2152e.—The polymer chain is considered as an equil. mixt. of rotational isomers. The chain is characterized by the degree of convolution, or the thermodynamic flexibility, and the kinetic flexibility. The degree of convolution is the ratio of the max. length of the chain to the length of the convoluted chain. A method is given for the calcn. of this ratio and it is applied to a series of polymers. A study of the properties of these mols. shows the relation between the flexibility of the mols. and their chem. structure.

J. Rovtar Leach

PTITSIN, O. B.

USSR/Physics - Polymers   Apr 53

"Statistical Physics of a Linear Polymeric Chain,"
M. V. Vol'kenshteyn and O. B. Ptitsin

Usp Fiz Nauk, Vol 49, No 4, pp 501-568

First part of a review that will be continued.
Analysis of statistical theory of an isolated chain
mol. Discusses possibility of predicting the phys pro-
perties of polymers from their chem structure. Assumes
the polymer to possess considerable number of degrees
of freedom, which is responsible for its great elasti-
city. Also discusses the rotating isomeric theory

267T90

of linear polymers and statistics of real polymeric
mols. Lists 125 references, 35 Soviet.

PTITSYN, C. B.

259T97

USSR/Physics – Molecular Lengths

21 Apr 53

"Length of the Molecular Chain in Cis-and Trans-Polydienes," A.A. Chistorazum, Inst of High-Molecular Compds, Acad Sci USSR

DAN SSSR, Vol 89, No 6, pp 999-1002

Calculations of mean square distances in chains with alternating double bonds and different valence angles in the case of the polymers polybutadiene, polyisoprene, and polydimethylbutadiene are given. Acknowledges the interest and assistance of M. V. Vol'kenshteyn and O. B. Ptitsyn, who developed the formulas for the mean square distance between ends of a chain having N identical bonds taking into account extent of hindrance of rotation around each bond (DAN SSSR, 78, 879 (1951)). Presented by Acad A.F. Ioffe 21 Feb 53.

259T97

USSR/Physics - Polymer Chains   21 Aug 53

"Stretching of Polymer Chains," M. V. Vol'kenshteyn
and O. B. Ptitsyn, Inst of High Molecular Compds,
Acad Sci USSR

DAN SSSR, Vol 91, No 6, pp 1313-1316

Conclude that for small extensions (disregarding
terms of the order x^3) the "energetic" elastic force
f_1 and the "entropic" elastic force f_2 connected
with the transition of convoluted isomers into trans-
isomers compensate each other; consequently, for small
extensions this transition does not change the free

275T95

energy of the chain and the recovering force bears
a purely entropic character. For large extensions
the above-indicated compensation will not hold.
Propose that a one-dimensional model in the main
correctly gives the dependence of stretching of
polymer chains upon their flexibility and external
force. Presented by Acad A. F. Ioffe 22 Jun 53.

PININ, I. B.

"Internal Rotation in Polymer Chains and Their Size and Mechanical Properties." Cand Phys-Math Sci, Inst of High Molecular Compounds, Acad Sci USSR, Leningrad, 1954. (RZhKhim, Sep 54)

SO: Sum 432, 29 Mar 55

BIRSHTEYN, T.M.; PTITSYN, O.B.

Physical properties of the internal rotation of polymer chains.
Part 1. Chemical structure and dipole moments of linear polymer
molecules in solution. Zhur.tekh.fiz. 24 no.11:1998-2010 N '54.
(MLRA 7:12)
(Polymers and polymerization) (Electric moments)

PTITSYN, O.B.

USSR/Chemistry – Physical chemistry

Card 1/1   Pub. 147 - 4/27

Authors   : Birshteyn, T.M., and Ptitsyn, O.B.

Title   : The geometry of linear polymers. Part 4.-Stereoisomerism of the polymeric
               chain

Periodical   : Zhur. fiz. khim. 28/2, 213-223, Feb 1954

Abstract   : The effect of stereoisomerism in polymeric chains, with asymmetric ad-
               ditions on the average dimensions of the chains, is discussed. It was
               found that the average dimensions of molecules of an identical polymer
               depend upon the orientation of the asymmetrical additions and that the
               physical properties of different stereoisomers belonging to one and the
               same polymer can be entirely different. The role of stereoisomerism in
               the dielectric properties of polar polymers is explained. It was es-
               tablished that the internal viscosity of polystyrene solutions depends
               upon temperature at which its polymerization takes place and that an in-
               crease in polymerization temperature results in considerable reduction in
               viscosity. Seventeen references : 9-USSR; 5-USA; 1-Chinese and 2-German
               (1943-1953). Drawings.
Institution : Institution of High Molecular Compounds, Leningrad
Submitted   : March 30, 1953

PTITSYN, O.B.

Some problems in the theory of vitrification (conference at the
Institute of High Molecular Compounds). Vest. AN SSSR 25 no.4:
92-93 Ap '55.   (MLRA 8:7)
     (Glass)

PTITSYN O. B.
USSR/Physics - Polymers

FD-2829

Card 1/1   Pub. 153-12/30

Author   : Volkenshteyn, M. V. and Ptitsyn, O. B.

Title   : Internal Rotation in Polymer Chains and Their Physical Properties

Periodical   : Zhur. Tekh.Fiz, 25, 649-661, 1955

Abstract   : The mean and mean square distances are computed between the ends of a polymer chain under action of an external force, which may be expressed by a series of the type $f(\ell/k)$, where ℓ means the length of a link. The problem is solved for an one- and two- dimensional model based on rotational-isomeric theory. Mechanisms of chain elongation are analyzed. It is proved that the diffusion analogy cannot be applied to the case of a chain under action of an external force. Fourteen references, 9 foreign.

Institution   :

Submitted   : September 8, 1955

VOL'KENSHTEYN, M.V.;   PTITSYN, O.B.

Physical properties and internal rotation in polymer chains. Part 3.Zhur.
tekh. fiz. 25 no.4:662-670 Ap '55.   (MIRA 8:5)
        (Polymers and polymerization) (Molecules) (Rubber)

PTITSYN, O. B.

Volume effects in branched polymer chains. O. B. Ptitsyn. Zhur. Fiz. Khim. 29, 396-8(1955); cf. C.A. 45, 10252h; 46, 24g.—Debye and Bueche (C.A. 46, 10790a) have shown that the lateral branches of chain mols. approx. follow a Gaussian distribution, and this is the basis of a theory of dimensions of branched polymers. Studies (C.A. 46, 1845a; 47, 8406d) on this theory have shown that, at the same mol. wt., the influence on the radius of inertia of a branched mol. is considerably greater than on the radius of inertia of a linear mol. and increases rapidly with increasing nos. of branches in the chains. A plot of the ratio of the mean square radius of inertia $\bar{R}^2\beta/\bar{R}^2$ (0-1), vs. the no. of branches β, (0-500) shows 2 curves, resp., with and without correction for vol. effects, from which it follows that vol. effects partly compensate for the decrease in dimensions of the mols. caused by branching. V. H. Gottschalk

Inst. Higher Molecular Compounds, Leningrad

Ptitsyn, O.B.

VOL'KENSHTEYN, M.V.; PTITSYN, O.B.

Relaxation theory of vitrification. Dokl.AN SSSR 103 no.5:795-798
Ag '55.
(MLRA 9:1)

1.Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR.
Predstavleno akademikom A.F.Ioffe.
                (Vitreous state)

PTITSYN, O. B.

Kinetics for the stabilization of glasses. O. B. Ptitsyn (Artem Mining Inst., Daepropetrovsk). *Doklady Akad. Nauk S.S.S.R.* 103, 1045-8(1955).—Theoretical. A mol. kinetic explanation is given for the asymmetry in the relaxation curves for vitreous substances (Davies and Jones, *C.A.* 47, 7809a), based on the model relaxation theory of vitrification (cf. preceding abstr.).   J. Rovtar Leach

PTITSYN, O. B. and VOL'KENSHTEYN, M. V.

Introduction by M. V. Vol'kenshteyn and O. B. Ptitsyn, Problemy Sovremennoy Fiziki, Vol 8, No 12, Dec 56, pp 3-5

This issue of the periodical Problemy Sovremennoy Fiziki, which publishes translated articles illustrating progress in various fields of physics outside the USSR, represents a collection of non-USSR articles on the physics of polymers. The translations contained in this issue have been edited by M. V. Vol'kenshteyn. Vol'kenshteyn and Ptitsyn comment as follows on five articles published as a separate section (pp 173-222) under the heading "The Action of Nuclear Radiation on Polymers":

"The last, sixth section of the collection of articles consists of papers that deal with the action of nuclear radiation on polymers. This field is of great interest from both the physical and the chemical standpoint, because the processes which take place in polymers under the action of radiation (cross-linking, etc.) lead to the formation of substances which have new and valuable properties. Investigation of the processes and characteristics involved is also of importance for nuclear technology, in which some high-polymer materials are applied."

Sum 1258

PTITSYN, O. B

SUBJECT   USSR / PHYSICS   CARD 1 / 2   PA - 1581
AUTHOR   WOL'KENŠTEJN,M.V., PTICYN,O.B.
TITLE   The Relaxation Theory of the Formation of Glass.
            I. Solution of the Basic Equation and its Examination.
PERIODICAL Žurn.techn.fis,26, fasc.10, 2204-2222 (1956)
            Issued: 11 / 1956

Proceeding from the most general molecular-kinetic ideas the basic laws of
glass formation and of softening are here derived. The theory found must then
be suited for all objects from which glass is formed. Relaxation processes are
here dealt with by an equation which describes the transition of kinetic units
from one energy state to another. The spectrum of relaxation times is on this
occasion neglected. Reaction may be of the first or second order ("isomeri-
zation" or "dimerization" respectively). The influence exercised by reactions
of a higher order may be neglected, In the case of a reaction of the first
order the elementary acts of transition from the nonexcited state (state 1) to
the excited state (state 2) take place with the participation of only one
kinetic unit. The reaction of the second order consists in the production and
dissociation of the bindings among the kinetic units. On the occasion of the
investigation of such relaxation processes which are connected with only
little deviations from equilibrium the equation of the first order may always
be used. Here only reactions of the first order are investigated. Reactions
of the second order are studied later.
At first an expression for the solution of the basic equation is given. On this

occasion the dependence of the transition probability on the structure of the
liquid is neglected. At first the most simple process is investigated in which
the exterior parameters of the system do not depend on time. Next, the case is
investigated in which the temperature of the system changes with constant or
variable velocity. The solutions found for the share V of the kinetic units
which are in an excited state are written down. There follows the mathematical
discussion of the solution obtained.

Forming of glass and softening: Every system satisfying the above conditions
is suited for the formation of glass in connection with cooling and for
softening during heating. Furthermore, equations are obtained which connect
the temperature of glass formation T_g' and of the softening T_g with the para-
meters of the system and with the modification velocity $|q|$. With increasing
$|q|$ also T_g and T_g' increase. Next, the solutions of the basic equation for the
vitrification interval and for the domains above and below the vitrification
interval are discussed. Among others, V does not depend on temperature
within the range below the vitrification interval, i.e. the structure of the
liquid is frozen.

INSTITUTION: Institute for Highly Molecular Compounds of the Academy of
             Science in the USSR.

PTITSEV, O. B.

"Theory of lightscattering of polymer slutions," a paper presented at the 9th Congress on the Chemistry and Physics of High Polymers, 28 Jan-2 Feb 57, Moscow, Polymer Research Inst.

B-3,084,395

PITSIN, O. B., and VOLKENSHTEIN, M. V.

"Relaxation theory of polymers," a paper presented at the 9th Congress on the Chemistry and Physics of High Polymers, 28 Jan-2 Feb 57, Moscow, Polymer Research Inst.

B-3,004,395

PRIKHOT'KO, A F.

24 (7)   p 3   PHASE I BOOK EXPLOITATION   SOV/1365

L'vov. Universytet

Materialy X Vsesoyuznogo soveshchaniya po spektroskopii. t. 1:
Molekulyarnaya spektroskopiya (Papers of the 10th All-Union
Conference on Spectroscopy. Vol. 1: Molecular Spectroscopy)
[L'vov] Izd-vo L'vovskogo univ-ta, 1957. 499 p. 4,000 copies
printed. (Series: Its: Fizychnyy zbirnyk, vyp. 3/8/)

Additional Sponsoring Agency: Akademiya nauk SSSR. Komissiya po
spektroskopii. Ed.: Jaxer, S.L.; Tech. Ed.: Saranyuk, T.V.;
Editorial Board: Landsberg, G.S., Academician (Resp. Ed., Deceased),
Neporent, B.S., Doctor of Physical and Mathematical Sciences,
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Candidate of Physical and Mathematical Sciences, Miliyanchuk, V.S.,
Candidate of Physical and Mathematical Sciences, and Glauberman,
A. Ye., Candidate of Physical and Mathematical Sciences.

Card 1/30

Vol'kenshteyn, M.V., and O.B. Ptitsyn. Behavior of
    Hydrogen Bonds During Vitrification

Lazarev, A.N. Vibrational Spectra of Orthosilicilic   437
    Acid Esters and Their Relation to Silicate Spectra

Lotkova, Z.N., V.V. Obukhov-Denisov, N.N. Sobolev,   440
    and V.P. Cheremisinov. Raman Spectrum of Vitreous
    Boric Anhydride

Sidorov, T.A., and N.N. Sobolev. Infrared Spectra   445
    and the Structure of Phosphorous, Phosphoric and
    Boric Anhydrides

Bobovich, Ya. S., and T.P. Tulub. Raman Spectra of   448
    Double-complex Silicate Glasses

Sevchenko, N.A., and V.A. Florinskaya. Reflection   455
    and Transmission Spectra of Various Modifications
    of Silica in the Wave Length Range From 7 to 24
    Microns

                                                                  456

Ptitsyn, O. B.

AUTHORS: Ptitsyn, O. B., Sharonov, Yu. A.   57-12-8/19

TITLE: Internal Rotation in Polymer Chains and Their Physical Properties
             (Vnutrenneye vrashcheniye v polimernykh tsepyakh i ikh fizicheskiye
             svoystva). VI. Dimensions and dipole moments of polyvinyl chains
             with large branches (VI. Razmery i dipol'nye momenty polivinilovykh
             tsepey s massivnymi priveskami)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1957, Vol.27, Nr 12, pp. 2744-2761 (USSR)

ABSTRACT: Differing from all previous papers, the equations deduced here not
             alone take into consideration the interaction of the atoms immedi-
             ately adjacent to the chain-binding in question, but also the
             interaction with the massive additions, for two atoms not connected
             to two neighouring atoms of the chain actually are able to approach
             each other to within a comparatively short distance on the occasion
             of an internal rotation in the molecules of low- and high-molecular
             compounds. Therefore the interaction between these atoms should by
             no means be neglected. The investigations conducted here show, that,
             if in the case of propane this interaction may, more or less, be
             neglected, this is in no case possible with butane. It is shown,
             that the equation for the potential energy must be replaced by another
Card 1/4   one, which takes into consideration the interaction (besides that of

Internal Rotation in Polymer Chains and Their Physical Properties   57-12-8/19

first order) of at least the second order. The process of ascer-
taining the mean value of configuration, however, leads to great
difficulties. In the case of the polymers of the $(-CH_2-CR_2-)_n$-
and of the $(-CH_2- CHR -)_n$-type, R denoting the massive
additious, the interactions of the R-groups constitute by
far the greater part of the interactions of second order.
The interactions of the methylene group may be neglected in
comparison with these. If, therefore, notation of the elements
of the principal chain is rearranged in such a way,
that the $-CH_2 - CR_2 -$ or the $-CH_2 -CHR -$ elements correspond
to the odd numbers and the $-CR_2 - CH_2 -$ or $-CHR - CH_2 -$
elements to the even numbers, the quantities $W(\varphi_{i-1}, \varphi_1)$,
corresponding to even "i" could be neglected. It is shown,
that in such a case the chain energy decomposes into terms
independent of each other and every term is dependent on the
angles of internal rotation around the two successive links.
From this it appears, that the chain-energy is no longer
added up from the potential energy of separate elements,

Card 2/4

Internal Rotation in Polymer Chains and Their Physical
Properties (contd)

but from the potential energies of the separate monomeric
units. Therefore the chain in this case represents a Markov-
chain and the process of ascertaining the mean value of
configuration may be conducted according to the methods
employed in the papers (reference 1 to 7). Here only the
polymers of the $(-CH_2-CR_2-)_n$ and $(-CH_2-CHR-)_n$ type are
investigated. Interactions of third order are neglected.
Equations are deduced, which express the dependence of the
average dimensions and of the average dipole-moments in
polyvinyle chains on the valence angles and on the parameters
of internal rotation. Chains with symmetric $(-CH_2-CR_2-)_n$ and
with unsymmetrical additious $(-CH_2-CHR-)_n$ were investigated,
in the case of the latter isotactical and "sindiotactical"
polymers. The formulae for h^2 and μ^2 obtained here are
distinguished from previous ones in two respects:
1.) New terms occur here, containing the following parameters:

Card 3/4

$$\eta_1 = \overline{\cos \varphi_{2s} \cos \varphi_{2s+1}} \; , \quad \eta_2 = \overline{\cos \varphi_{2s} \sin \varphi_{2s+1}} \; , \; \text{and}$$

$\mathcal{E}_1 = \overline{\sin \gamma_{2s} \; \sin \gamma_{2s+1}}$. These parameters characterize
the interrelation between the rotation of the neighbouring
CR_2-CH_2 and CH_2-CR_2 elements or $CHR-CH_2$ and CH_2-CHR elements.
2.) The values of the former parameters, which characterize
the rotation around one element, must now be computed with
consideration of the interaction of the massive additious.
It is shown, that the new terms play an important part in the
formulae obtained here. For the purpose of applying the equa-
tion obtained here to the computation of the average dimen-
sions and of the dipole moments of the real polymer chains
the conditions of the internal rotationsin these chains must
be known. This question will be dealt with in the next paper.
Collaborators in this investigation were:M. V. Vol'kenshteyn
and Yu.Ya. Gotlib. There are 6 figures, and 19 references, 7
of which are Slavic.

ASSOCIATION: Institute for High-Molecular Compounds AN USSR, Leningrad
               (Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad).
SUBMITTED: March 21, 1957.
AVAILABLE: Library of Congress
Card 4/4

AUTHORS: Ptitsyn, O. B.,   Sharonov, Yu. A.   57-12-9/19

TITLE: Internal Rotation in Polymer Chains and Their Physical
            Properties   (Vnutrenneye vrashcheniye v
            polimernykh tsepyakh i ikh fizicheskiye svoystva). VII. On
            the Configuration of Polymer Chains in the Crystalline State
            and in Solution (VII. Konfiguratsiya polimernykh tsepey v
            kristallicheskom sostoyanii i v rastvore).

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1957, Vol. 27, Nr 12,
            pp. 2762-2773 (USSR)

ABSTRACT: In this paper a method for the evaluation of the parameters
            characterizing the thermodynamic elasticity of polymer
            chains in a solution is proposed, starting from a crystalline
            configuration of the chains. The method is based on the
            assumption, that the polymer chains crystallize in that
            configuration, which is the most stable in a solution. Apart
            from this, the method is based on the utilization of the
            symmetric properties of polymer chains of the $(-CH_2-CR_2-)n$ -
            and $(-CH_2-CHR-)_n$ - type. This method was here employed for
Card 1/2   the determination of the configuration of the polyisobutylene

Internal Rotation in Polymer Chains and Their Physical
Properties   57-12-9/19

chain and of the chain of the isotactical polystyrole. With
the help of the equations obtained in the previous paper
(reference 6) and of the configurations obtained in this
way the average dimensions of the polyisobutylene chain
and of the chain of the isotactical polystyrole in ideal
solvents are computed, as well as the average dipole moments
of the para-halogenic substituent of the isotactical
polystyrole. Although the experimental data refer to non-
tactical and not to isotactical polymers, a comparison of
the data obtained here with the experimantal results is
given here. M.V.Vol'kenshteyn collaborated in this
investigation. There are 2 figures, 2 tables, and 43
references, 12 of which are Slavic.

ASSOCIATION: Institute for Highly Molecular Compounds AN USSR, Leningrad
                (Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad).

SUBMITTED: March 21, 1957.

AVAILABLE: Library of Congress

Card 2/2

PTITSYN O B

The geometry of linear polymers. V. The scattering of light by polymer clusters and the volume effects. O. B. Ptitsyn. Zhur. Fiz. Khim, 31, 1091-102(1957); cf. C.A. 49, 6690a.—The macromol. vol. effects decreased the assymetry of light scattering to a value lower than predicted by the Debye theory (C.A. 41. 2293h). An investigation of the scattering in a single polymer fraction within a wide range of angles permits the determinability of the mol. sizes in the fraction, but also the roots of even these sizes and the distribution of the radii of gyration from the light intensity scattered at 45 and 135° and an estn. of the polydispersion and branching of the polymer mols. by light scattering methods can be done only in poor solvents, in which the vol. effects are negligible.   W. M. Sternberg

Inst. Higher Molecular Compounds

PTITSYN, O. B.

Ptitsyn, O.B., Birshteyn, T.M. and Sharonov, Yu. A.   [Institut vyso-
ko-molekulyarnykh soyedineniy AN SSSR (Institute of High-molecular
Compounds AS USSR)] Theory on Dipole Moments of Polymeric Molecules

(The Physics of Dielectrics; Transactions of the All-Union Conference on the Physics
of Dielectrics) Moscow, Izd-vo AN SSSR, 1958.   245 p.   3,000 copies printed.

This volume publishes reports presented at the All-Union Conference on the Physics of
Dielectrics, held in Dnepropetrovsk in August 1956, sponsored by the "Physics of
Dielectrics" Laboratory of the Fizicheskiy institut imeni Lebedeva An SSSR (Physics
Institute imeni Lebedev of the AS USSR), and the Electrophysics Department of the
Dnepropetrovskiy gosudarstvennyy universitet (Dnepropetrovsk State University).

PTITSYN, O. B. (IVS AS USSR, Leningrad)

O. B. Ptitsyn, G. M. Birshteyn and, Yu. A. Sharonov, "Interior Rotational Isomerism in Polyisobutylene and Polystyrene."

report presented at the Symposium on Concepts of Conformation in Organic Chemistry which took place in Moscow at the IOKh AN SSSR (Institute of Organic Chemistry, AS USSR) from September 30 to October 2, 1958.

Izvestiya Akademii nauk SSSR, Otdeleniye khimicheskikh nauk, 1959, No. 3, 561-564.

48-22-3-23/30

AUTHORS: Ptitsyn, O. B., Birshteyn, T. M., Sharonov, Yu. A.

TITLE: Theory of the Dipole-Moments of Polymeric Molecules (Teoriya dipol'nykh momentov polimernykh molekul) Report Theses (Tezisy doklada)
For Details Consult T. M. Birshteyn, O. B. Ptitsyn, ZhTF, 24, 1998 (1954), O. B. Ptitsyn, Yu. A. Sharonov, ZhTF, 27, 2744, (1957)(Podrobno sm. T. M. Birshteyn, O. B. Ptitsyn, ZhTF, 24, 1998 (1954) O. B. Ptitsyn, Yu. A. Sharonov, ZhTF, 27, 2744, (1957)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1958, Vol. 22, Nr 3, pp. 324 - 324 (USSR)

ABSTRACT: 1) A theory of the dipole-moments of the polymer-molecules was proposed which connects the mean square of the dipole-moment of the polymeric chain with its chemical structure, with the stereoisomerism and with the retarding of inner rotation.

Card 1/4   The theory refers to the polymers of the type $(-CR_2-)_n$,

48-22-3-23/30

Theory of the Dipole-Moments of Polymeric Molecules. **Report Theses**
            . For Details Consult T. M. Birshteyn, O. B. Ptitsyn, ZhTF,
24, 1998 (1954) O. B. Ptitsyn, Yu. A. Sharonov, ZhTF, 27, 2744, (1957)

$(-CH_2-CR_2-)_n$, $(-CH_2-CHR-)_n$ and $(-CHR-)_n$, where R is a polar pendant(privesok).Besides the first approximation of the theory which takes only account of the interaction between the nearest chain-series, also a second approximation was obtained which takes account also of more far distanced series. 2) It was shown that the dipol-moment can largely depend on the stereoisomerism of the chain: with chains of the type $(-CH_2-CHR-)_n$

and especially $(-CHR-)_n$ the dipole-moment is substantially smaller with the dl- than with the dd- position of the polar groups (under equal conditions of inner rotation in the chain). It was also shown that in chains of the type $(-CH_2-CHR-)_n$ with

Card 2/4   closely connected dipoles the dipole-moment depends on the
               circumstance which pendants - polar or non-polar - mutually

48-22-3-23/3o

Theory of the Dipole-Moments of Polymeric Molecules.
Report Theses.   . For Details Consult T. M. Birshteyn, O. B. Ptitsyn, ZhTF,
24, 1998 (1954) O. B. Ptitsyn, Yu. A. Sharonov, ZhTF, 27, 2744,(1957)

repel more intensely. When an inner rotation takes place
in polar pendants, then the dipole moment does not depend
on the structure in the first approximation. 3) A comparison
of the theory with the experimentally found values according
to poly-p-halogen styrenes and polychlorovinyl show that
in the chains of these polymers the phenyl series or the
chlorine atoms repel mutually more intensely than the hydrogen
stoms. The degree of retardation of rotation in these poly-
mers which was determined according to dipole moments in
accordance with experimentally obtained data corresponds
approximately to the values determined from the size of the
molecules and from the photoelastic moment.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR
              (Institute for High- Molecular Compounds AS USSR)

Card 3/4

48-22-3-23/3o

Theory of the Dipole-Moments of Polymeric Molecules.
 Report Theses. . For Details Consult T. M. Birshteyn, O. B. Ptitsyn, ZhTF,
. 24, 1998 (1954) O. B. Ptitsyn, Yu. A. Sharonov, ZhTF, 27, 2744,(1957)

AVAILABLE: Library of Congress

           1. Polymeric molecules--Dipole moments--Theory

Card 4/4

AUTHORS: Tsvetkov, V. N., Frisman, E. V., Ptitsyn, O. B. 30V/57-28-7-11/35
              Kotlyar, S. Ya.

TITLE: The Shape Effect in the Dynamic Double Refraction of Polymer
              Solutions (Effekt formy v dinamicheskom dvoynom lucheprelom-
              lenii rastvorov polimerov)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Vol. 28, Nr 7, pp.1428-1436
              (USSR)

ABSTRACT: The authors suggest a theory of the shape effect in the dynamic
              double refraction of polymer solutions. The taking into ac-
              count of the shape effect in the theory of dynamic double re-
              fraction is suggested on the basis of the model by Tsvetkov
              and Frisman (Ref 9). According to this model the macromole-
              cule in a solution is regarded as an ellipsoidal macroscopic
              particle saturated with the solvent. The refraction index
              of such a particle is different from the refraction index
              of the solvent. Thus the particle does not only have an in-
              trinsic anisotropy but also an anisotropy of shape. The lat-
              ter can be calculated according to the known formula by
Card 1/3   Maxwell (Refs 10 and 11) concerning the anisotropy of the

SOV/57-23-7-11/35
The Shape Effect in the Dynamic Double Refraction of Polymer Solutions

shape of macroscopic particles. It is shown that in the
case of small velocity gradients the shape effect increases
proportionally to the gradient, while in the case of great
gradients it tends toward a constant value. The theory
given expresses well the experimental data and in particular
case also the earlier-found dependence of the sign of the
double refraction of a solution of polystyrene in dioxane
on the velocity gradient. Finally the authors refer to the
works by M. Čopič (Refs 17 and 18) and they show that in
spite of the great difference in the models used and in
spite of a number of assumptions in either theory they co-
incide well (viz. this theory and that by Čopič). There are
2 figures, 2 tables, and 18 references, 8 of which are Soviet.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR (Institute
of High Molecular Compounds, AS USSR)
Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova
(Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: May 11, 1957
Card 2/3

The Shape Effect in the Dynamic Double
Refraction of Polymer Solutions

SOV/57-28-7-11/35

1. Polymer solutions--Refraction

Card 3/3

5(4) 10
AUTHORS: Ptitsyn, O. B., Eyzner, Yu. Ye.   SOV/76-32-10-38/39

TITLE: The Characteristic Viscosity of Polymers in Good Solvents
              (Kharakteristicheskaya vyazkost' polimerov v khoroshikh
              rastvoritelyakh)

ABSTRACT: According to Flory (Flori) (Ref 3) the exchange of a bad
              against a good solvent leads to an increase of the
              characteristic viscosity (η) according to the increase of the
              macromolecule. This assumption must, however, be made more
              precise, as in good solvents the polymer chains do not obey
              the Gauss statistics. Proceeding from an equation according
              to Zimm (Tsimm) (Ref 2) and that by Kirkwood and Riseman
              (Kirkvud and Rayzman) (Ref 1), as well as by Peterlin (Ref 5)
              by means of the Fourier (Fur'ye) series the values for λ'_k
              are calculated at $\varepsilon = 0$, 0.02, 0.04, 0.06, 0.08, 0.12, 0.16
              and 0.20 and then are mentioned in a table. It was found that
              on an increase of the value ε from 0 (ideal solvent) to 0.20
Card 1/2   (good solvent) the value ϕ decreases from $2.84 \cdot 10^{23}$ to $1.67 \cdot 10^{23}$.

The Characteristic Viscosity of Polymers in Good   SOV/76-32-10-38/39
Solvents

The function ϕ versus the quality of the solvent was
investigated by Krigbaum and Carpenter (Karpenter) (Ref 7).
The dependence of the value ϕ on the quality of the solvent
is in the present case explained by the fact that there is
a greater steric effect on the distances of the segments
of the polymer chains that are at a greater distance from
each other. The calculations were carried out at the
Leningradskoye otdeleniye Matematicheskogo instituta AN SSSR
im. V. A. Steklova (Leningrad Department of the Institute of
Mathematics AS USSR imeni V. A. Steklov) under the supervision
of N. P. Rynkevich. There are 1 figure, 1 table, and 7
references, 1 of which is Soviet.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR
               (Institute of High Molecular Compounds, AS USSR)

SUBMITTED: July 17, 1957

Card 2/2

VOL'KENSHTEYN, Mikhail Vladimirovich. Prinimali uchastiye: BIRSHTEYN, T.M.;
GOTLIB, Yu.Ya.; PTITSIYN, O.B.. BRESLER, S.Ye., prof., doktor
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tekhn.red.

[Configuration statistics of polymer chains] Konfiguratsionnaia
statistika polimernykh tsepei. Moskva, Izd-vo Akad.nauk SSSR,
1959. 466 p.   (MIRA 12:8)
                    (Polymers)

PTITSYN, O.B.

Geometry of linear polymers. Part 6: Theory of volume effect in
polymer chains. Vysokom.soed. 1 no.5:715-729 My '59.
(MIRA 12:10)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Polymers)

BIRSHTEYN, T.M.; PTITSYN, O.B.

        Stereospecificity of polymers as a function of polymerization
        conditions. Vysckom. soed. 1 no.6:846-851 Je '59.

                                       (MIRA 12:10)

        1.Institut vysokomolekulyarnykh soyedineniy AN SSSR.
                (Polymerization)

BIRSHTEYN, T.M.; PTITSYN, O.B.; SOKOLOVA, Ye.A.

Internal rotation and physical properties of polymer chains. Part
17: Conformation of polyisobutylene and polydimethylsiloxane mole-
cules in solution. Vysokom. soed. 1 no.6:852-856 Je '59.
(MIRA 12:10)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Siloxane)   (Propene) (Chemistry, Physical and theoretical)

PTITSYN, O.B.

Internal rotation in polymer chains and their physical properties.
Part 14: Effect of stretching on the intensity of vibration spectra
of polymers. Fiz. tver. tela 1 no.6:923-928 Je '59.
(MIRA 12:10)

1.Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad.
(Polymers--Spectra)

PTITSYN, O.B.; EYZNER, Yu.Ye.

Hydrodynamics of polymer solutions. Part 3: Influence of volume effects on light scattering and on the friction coefficient of macromolecules in solution. Vysokom.soed. 1 nc.7:966-977 Jl '59.

(MIRA 12:11)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Macromolecular compounds)

VOL'KENSHTEYN, M.V.; GOTLIB, Yu.Ya.; PTITSYN, O.B.

    Theory of high elasticity of rubbers. Vysokom.soed. 1 no.7:1058-
    1062 Jl '59.   (MIRA 12:11)

    1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
                 (Rubber, Synthetic)

PTITSYN, O.B.; EYZNER, Yu.Ye.

Molecular interaction in polymer solutions. Part 1: In-
fluence of volume effects on the second virial coefficient.
Vysokom.soed. 1 no.8:1200-1206 Ag '59.   (MIRA 13:2)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Polymers)
(Chemistry, Physical and theoretical)

PTITSYN, O.B.

Hydrodynamics of polymer solutions. Part 1: Diffusion and sedimentation of branched macromolecules. Zhur.tekh.fiz. 29 no.1:
75-93 Ja '59.   (MIRA 12:4)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad.
                        (Polymers)

5(4)

SOV/53-69-3-2/6

AUTHOR: Ptitsyn, O. B.

TITLE: Innermolecular Interactions in Polymer Chains

ABSTRACT: The present article gives a survey of published works dealing
with effect, methods of determination, and data concerning the
inner interaction in chain molecules, taking especially the ef-
fects of long-range order into account. With respect to a more
detailed representation of the long-range interaction, reference
is made to a monograph by M. V. Vol'kenshteyn (Ref 9) as well
as other surveys of this subject (Refs 10,11). In the intro-
duction the problem is discussed, several fundamental formulas
and definitions are given, and reference is made to a number of
publications dealing with this subject. Chapter 2 gives a short
representation of short-range interactions and their delaying
effect on internal rotation (cf Fig 1), and in 3 tables covering
several pages (composed from a large number of publications)
the length of the molecules in solution, the dipole moments and
the optical anisotropy as well as the structural formulas of the
monomeric units are given for various polymers. The following

Card 1/3

Innermolecular Interactions in Polymer Chains   SOV/53-69-3-2/6

chapter deals with the representation of an approximation theory
of long-range interaction in polymer chains. The representation
of the theory was obtained from papers by Flory, Fox and
Orofino (Refs 107-109). The conclusions drawn are given (inter-
relations between molecule dimensions and flexibility, solvent
and molecular weight, significance of the critical temperature θ
etc.); the interrelations are illustrated by formulas and
diagrams. Chapter 4 gives a representation of an exact theory
of long-range interactions according to references 131, 139-146
(Flory's theory leads to no quantitative agreement with the ex-
periments). The formulas characterizing the relations are given
without derivations. Chapter 5 deals with the theory (and a
short comparison with the experiments) of the effect exercised
by long-range interactions upon the light dispersion in solu-
tions of polymers; as these interactions cause a deviation from
the distributions of the distances between the chain segments
from the Gaussian form, an effect occurs in the distribution of
the dispersed light, which is characterized by $P(\vartheta) = I(\vartheta)/I(\vartheta)$
(cf. Fig 8). I is the intensity of the light dispersed under
the angles of ϑ and 0°. Chapter 6 shows the interrelations
Card 2/3   between long-range interactions and the hydrodynamic properties

Innermolecular Interactions in Polymer Chains   SOV/53-69-3-2/6

of the macromolecules (influence exercised on the translatory
motion of molecules - Braun's motion or motion caused by centri-
fugal forces - and the laminary flow of a solution; determina-
tion of diffusion- and sedimentation coefficients and velocity
gradients; introduction of the Flory coefficient £ empirically
and theoretically). Chapter 7 contains a few concluding remarks.
The following Soviet scientists are mentioned: T. M. Birshteyn,
V. Ye. Eskin, V. N. Tsvetkov, K. Z. Fattakhov, G. P. Mikhaylov,
O. N. Trapeznikova, I. A. Krym, N. M. Bazhenov, Yu. Ya. Gotlib,
L. D. Rozenshteyn, S. Ya. Magarik, V. Ye. Bychkova, S. M.
Savvon, I. I. Pekrasov, S. Ye. Bresler, Ya. I. Frenkel', V. N.
Nikitin, V. Z. Volchek, E. K. Byutner, Yu. A. Sharonov, Ye. A.
Sokolova, Yu. Ye. Eyzner, E. V. Frisman, M. G. Okuneva, S. I.
Klenin, A. K. Kron, N. A. Domnicheva, and S. Ya. Lyubina. There
are 10 figures, 3 tables, and 233 references, 80 of which are
Soviet.

Card 3/3

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SOV/20-129-1-45/54

5(4)   5.3831

AUTHOR: Ptitsyn, O. B.

TITLE: Determination of Undisturbed Dimensions of Macromolecules in
              Good Solvents

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 1, pp 165-167
              (USSR)

ABSTRACT: The theory of the second virial coefficient A_2 was developed by
              P. Flory (Ref 2), W. Krigbaum (Ref 7), and T. Orofino (Ref 6).
              In reference 9 the author, together with Yu. Ye. Eyzner, by mak-
              ing allowance for the effect of intramolecular interactions on
              A_2, precizises the theory to such an extent, that the determina-
              tion of undisturbed dimensions of macromolecules, and the deter-
              mination of A_2 and the molecular weight has become possible. A_2

              is represented as a function of $\Psi(\alpha)$ (Fig 1), $\alpha = \left(\overline{R^2}/\overline{R_0^2}\right)^{\frac{1}{2}}$ (where

              $\overline{R^2}$ = mean square of the radius of inertia of the molecule, and
              $\overline{R_0^2}$ = mean square of the radius of inertia of the chain at the

Card 1/2

PTITSYN, O. B., BIRSHTEIN, T. M. and GOTLIB, Yu. Ya. (USSR)

Mikrotaktichnost polimerov i metody ee issledovaniya
The microtacticity im polymers and methods of its investigation
IUPAC S II: 388-95

report presented at the Intl. Symposium on Macromolecular Chemistry, Moscow,
14-18 June 60

PTITSYN, O.B.

Geometry of linear polymers. Part 7: Influence of volume effects on the shapes of macromolecules in solution. Vysokom. soed. 2 no. 3:390-396 Mr '60.

(MIRA 13:11)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Polymers)

PITITSYN, O.B.

Potentiometric titration and conformations of the macromolecules
of iso- and syndiotactic polyelectrolytes. Vysokom. soed.
2 no. 3:463-464 Mr '60.   (MIRA 13:11)
        (Electrolytes)   (Potentiometric analysis)

BIRSHTEYN, T.M.; PTITSYN, O.B.

Conformation, dimensions, and dipole moments of syndiotactic macromolecules. Vysokom. soed. 2 no.4:628-629 Ap '60.

(Macromolecular compounds)   (Dipole moments)   (MIRA 13:11)

PTITSIN, O. B., BIRSHTEYN, G. M., VOLKENSHTEYN, M. V., GODZHAYEV, N. M.,
GOTLIB, YU. YA., and YELYASHEVICH A. M. (USSR)

"Statistic Thermodynamic and Kinetic Model Theory of Biosynthesis."

Report presented at the 5th International Biochemistry Congress,
Moscow, 10-16 Aug 1961

VOL'KENSHTEYN, M.V.; GODZHAYEV, N.M.; GOTLIB, Yu.Ya.; PTITSYN, O.B.

Kinetics of the reduplication of desoxyribonucleic acid. Uch. zap.
AGU. Ser. fiz.-mat. i khim. nauk no.4:105-112 '61.   (MIRA 16:6)
(Nucleic acids)

16 6100   1344 , 1103, 1·27

AUTHORS: Vol'kenshteyn, M. V., Gotlib, Yu. Ya., and Ptitsyn, O. B.

TITLE: The kinetics of cooperative processes

PERIODICAL: Fizika tverdogo tela, v. 3, no. 2, 1961, 420-428

TEXT: The solution of the kinetic equations describing the cooperative
processes occurring in changes of state (e.g. in fluids) is connected with
considerable mathematic difficulties, if the state parameters change
continuously with the coordinates and the momenta of the interacting
particles. However, it is mostly sufficient to investigate two or more
discrete values of the parameters of state, which simplifies calculations
considerably. The authors now developed a method permitting solution of
the kinetic equations for cooperative systems by means of discrete state
parameters by successive approximations. The interrelation between this
method and others (e.g. as developed by N. N. Bogolyubov) is discussed;
the present method is suited for studying cooperative kinetic processes
of the structural change in liquids and solids. Such chemical processes
are considered to be cooperative as occur on a certain matrix; in

Card 1/12

20118

The kinetics of cooperative ...

S/181/61/003/002/016/050
B102/B204

heterogeneous catalysis, e.g. the catalyst plays the role of such a matrix. The synthesis of albumens and nucleic acids, e.g. occurs only on matrices with the participation of ferments. It may be assumed that in biosynthesis, the cooperative processes play the main part. Here a system is investigated which consists of N correlated subsystems; the probability of the change of a state of a subsystem is assumed to depend not only on its state but also on the state of the neighboring subsystems. Thus, the probability of a change in state (transition), depends only on states and not on the transition of the neighboring subsystems, so that only a single transition need be investigated. For the state distribution function $F(\alpha_1, \alpha_2, \ldots \alpha_N) = F\{\alpha\}$ the kinetic equation

$$\frac{dF\{\alpha\}}{dt} = -F\{\alpha\} \sum_j \sum_{\alpha'_j \neq \alpha_j} w_{\alpha_j \to \alpha'_j}(\{\alpha\}, \alpha'_j) +$$

$$+ \sum_j \sum_{\alpha'_j \neq \alpha_j} F(\alpha_1, \alpha_2, \ldots \alpha_{j-1}, \alpha'_j, \alpha_{j+1}, \ldots \alpha_N) w_{\alpha'_j \to \alpha_j}(\{\alpha\}, \alpha'_j), \quad (1)$$

Card 2/12

20118

The kinetics of cooperative ...

holds, where w denote the transition probabilities. The partial distribution functions of n-th order, which depend on the state n of the sub-system are introduced with

$$F^{(n)}(\alpha_{i_1}, \alpha_{i_2}, \ldots \alpha_{i_n}) = \sum_{(k \neq i_1, i_2, \ldots i_n)} \cdots \sum_{\alpha_k} F\{\alpha\}. \qquad (2)$$

and finally one obtains for the partial distribution functions

$$\frac{dF^{(1)}(\alpha_i)}{dt} = - \sum_{\alpha_{i_1} \ldots \alpha_{i_s}} F^{(s+1)}(\alpha_i, \alpha_{i_1}, \alpha_{i_2}, \ldots \alpha_{i_s}) \times$$

$$\cdot \times \sum_{\alpha_i'} w_{\alpha_i \to \alpha_i'}(\alpha_i, \alpha_i', \alpha_{i_1}, \ldots \alpha_{i_s}) + \sum_{\alpha_{i_1} \ldots \alpha_{i_s}} \sum_{\alpha_i'}$$

$$F^{(s+1)}(\alpha_i', \alpha_{i_1}, \alpha_{i_2}, \ldots \alpha_{i_s}) w_{\alpha_i' \to \alpha_i}(\alpha_i', \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}),$$

$$\frac{dF^{(2)}(\alpha_i, \alpha_k)}{dt} = - \sum_{\alpha_{i_1} \ldots \alpha_{i_{k-1}} \alpha_{i_{k+1}} \ldots \alpha_{i_s}} F^{(s+1)}(\alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}) \times$$
$$(k = 1, 2, \ldots z)$$

$$\times \sum_{\alpha_i'} w_{\alpha_i \to \alpha_i'}(\alpha_i, \alpha_i', \alpha_{i_1}, \ldots \alpha_{i_s}) - \sum_{\alpha_{i_1} \ldots \alpha_{i_{k-1}} \alpha_{i_{k+1}} \alpha_{i_s} \alpha_{i_1} \ldots \alpha_{i_l}}$$

$$(3)$$

Card 3/12

20118

The kinetics of cooperative ...

$$F^{(s+l_k+1)}(\alpha_{i}, \alpha_{i_1}, \ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l}) \sum_{\alpha'_{i_k}} w_{\alpha_{i_k} \to \alpha'_{i_k}}(\alpha_{i_k}, \alpha'_{i_k}, \alpha_{i},$$

$$\alpha_{i_1}, \ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l}) + \sum_{\alpha_{i_1} \ldots \alpha_{i_{k-1}} \alpha_{i_{k+1}} \ldots \alpha_{i_s}} \sum_{\alpha'_i} F^{(s+1)}(\alpha'_i, \alpha_{i_1}, \ldots \alpha_{i_s}) \times$$

$$\times w_{\alpha'_i \to \alpha_i}(\alpha'_i, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}) + \sum_{\alpha_{i_1} \ldots \alpha_{i_{k-1}}, \alpha_{i_{k+1}}, \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l} \alpha_{i_k}} \sum_{\alpha'_{i_k}}$$

$$F^{(s+l_k+1)}(\alpha_i, \alpha_{i_1}, \ldots \alpha_{i_{k-1}}, \alpha'_{i_k}, \alpha_{i_{k+1}}, \ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l}) \times$$

$$\times w_{\alpha'_{i_k} \to \alpha_{i_k}}(\alpha'_{i_k}, \alpha_{i_k}, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l})$$

$$\frac{dF^{(s+1)}(\alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s})}{dt} = -F^{(s+1)}(\alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}) \times$$

4

Card 4/12

20118

The kinetics of cooperative ...

S/181/61/003/002/016/050
B102/B204

$$\times \sum_{\alpha'_i} w'_{\alpha_i \to \alpha'_i}(\alpha_i, \alpha'_i, \alpha_{i_1}, \ldots \alpha_{i_s}) - \sum_{k=1}^{s} \sum_{\alpha_{j_1} \ldots \alpha_{j_l}} F^{(s+l_k+1)}(\alpha_{i_1}, \alpha_{i_1},$$

$$\ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l}) \sum_{\alpha'_{i_k}} w_{\alpha_{i_k} \to \alpha'_{i_k}}(\alpha_{i_k}, \alpha'_{i_k}, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s},$$

$$\alpha_{j_1}, \ldots \alpha_{j_l}) + \sum_{\alpha'_i} F^{(s+1)}(\alpha'_i, \alpha_{i_1}, \ldots \alpha_{i_s}) w_{\alpha'_i \to \alpha_i}(\alpha'_i, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}) +$$

$$+ \sum_{k=1}^{s} \sum_{\alpha_{j_1} \ldots \alpha_{j_l}} \sum_{\alpha'_{i_k}} F^{(s+l_k+1)}(\alpha_i, \alpha_{i_1}, \ldots \alpha_{i_{k-1}}, \alpha'_{i_k}, \alpha_{i_{k+1}}, \ldots \alpha_{i_s},$$

$$\alpha_{j_1}, \ldots \alpha_{j_l}) \times w_{\alpha'_{i_k} \to \alpha_{i_k}}(\alpha'_{i_k}, \alpha_{i_k}, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}, \alpha_{j_1}, \ldots \alpha_{j_l}).$$

(4)

which may be solved according to the method of successive approximations.
Here the first approximation agrees with the zero-th approximation of
the Bogolyubov power expansion. In first approximation,

Card 5/12

20118

The kinetics of cooperative ...

$$F_1^{(n)}\left(\alpha_{i_1}, \alpha_{i_2}, \cdots \alpha_{i_n}\right) = \prod_{k=1}^{n} F_1^{(1)}\left(\alpha_{i_k}\right) \quad \text{holds; for } F_1^{(1)}(\alpha_i) \text{ one}$$

obtains the system

$$\frac{dF_1^{(1)}(\alpha_i)}{dt} = -F_1^{(1)}(\alpha_i) \sum_{\alpha_{i_1}\cdots\alpha_{i_f}} \prod_{k=1}^{f} F_1^{(1)}(\alpha_{i_k}) \sum_{\alpha_i'} w_{\alpha_i \to \alpha_i'} (\alpha_i, \alpha_i', \alpha_{i_1}, \cdots \alpha_{i_f}) +$$

$$+ \sum_{\alpha_i'} F_1^{(1)}(\alpha_i') \sum_{\alpha_{i_1}\cdots\alpha_{i_f}} \prod_{k=1}^{f} F_1^{(1)}(\alpha_{i_k}) w_{\alpha_i' \to \alpha_i} (\alpha_i', \alpha_i, \alpha_{i_1}, \cdots \alpha_{i_f}). \qquad (6)$$

From the equivalence of all subsystems one obtains as normalization

condition $\sum_{p=1}^{f} F^{(1)}(\alpha_i^{(p)}) = 1$, independent of i. (6) supplies the

function $F^{(1)}(\alpha)$ in first approximation; in order to obtain this
function in second approximation, it is necessary to substitute

Card 6/12

20118

The kinetics of cooperative ...

S/181/61/003/002/016/050
B102/B204

function $F^{(z+1}_{k+1)}$ in first approximation into the last equation of (4), whose solution gives $F^{(z+1)}$ in second approximation. If then $F_2^{(z+1)}$ is substituted into (3),

$$\frac{dF^{(1)}(\alpha_i)}{dt} = - \sum_{\alpha_{i_1},\ldots\alpha_{i_s}} F^{(s+1)}(\alpha_i, \alpha_{i_1}, \alpha_{i_2}, \ldots \alpha_{i_s}) \times$$

$$\times \sum_{\alpha'_i} w_{\alpha_i \to \alpha'_i}(\alpha_i, \alpha'_i, \alpha_{i_1}, \ldots \alpha_{i_s}) +$$

$$+ \sum_{\alpha_{i_1},\ldots,\alpha_{i_s},\alpha'_i} F^{(s+1)}(\alpha'_i, \alpha_{i_1}, \alpha_{i_2}, \ldots \alpha_{i_s}) w_{\alpha'_i \to \alpha_i}(\alpha'_i, \alpha_i, \alpha_{i_1}, \ldots \alpha_{i_s}) -$$

$$- \sum_{\alpha_k, k \neq i} \sum_{j \neq i} F\{\alpha\} \sum_{\alpha'_j} w_{\alpha_j \to \alpha'_j}(\alpha_j, \alpha'_j, \alpha_{j_1}, \ldots \alpha_{j_s}) +$$

$$+ \sum_{\alpha_k, k \neq i} \sum_{j \neq i} \sum_{\alpha'_j} F(\alpha_1, \alpha_2, \ldots \alpha_{j-1}, \alpha'_j, \alpha_{j+1}, \ldots \alpha_N) \times$$

$$\times w_{\alpha'_j \to \alpha_j}(\alpha'_j, \alpha_j, \alpha_{j_1}, \ldots \alpha_{j_s}), \tag{3}$$

Card 7/12

20118

The kinetics of cooperative ...

one obtains $F^{(1)}(\alpha)$ in second approximation. In order to obtain $F^{(1)}(\alpha)$ in third approximation, it is necessary to know $F_2^{(z+1_k+1)}$ etc.

This method is explained on the basis of the example of a linear cooperative system (e.g. macromolecule). The equations (10) - (12) are obtained, by means of which the distribution functions of arbitrary order may be determined.

$$\frac{dF^{(1)}(\alpha_i)}{dt} = - \sum_{\alpha_{i-1},\, \alpha_{i+1}} F^{(3)}(\alpha_{i-1},\, \alpha_i,\, \alpha_{i+1})\, w_{\alpha_i \to \alpha_i'}(\alpha_{i-1},\, \alpha_i,\, \alpha_i',\, \alpha_{i+1}) +$$

$$+ \sum_{\alpha_{i-1},\, \alpha_{i+1}} F^{(3)}(\alpha_{i-1},\, \alpha_i',\, \alpha_{i+1})\, w_{\alpha_i' \to \alpha_i}(\alpha_{i-1},\, \alpha_i',\, \alpha_i,\, \alpha_{i+1}). \qquad (10)$$

Card 8/12

The kinetics of cooperative ...

$$\frac{dF^{(2)}(\alpha_i,\ \alpha_{i+1})}{dt}=-\sum_{\alpha_{i-1}}F^{(3)}\left(\alpha_{i-1},\ \alpha_i,\ \alpha_{i+1}\right)w_{\alpha_i\to\alpha'_i}\left(\alpha_{i-1},\ \alpha_i,\ \alpha'_i,\ \alpha_{i+1}\right)-$$

$$-\sum_{\alpha_{i+2}}F^{(3)}\left(\alpha_i,\ \alpha_{i+1},\ \alpha_{i+2}\right)w_{\alpha_{i+1}\to\alpha'_{i+1}}\left(\alpha_i,\ \alpha_{i+1},\ \alpha'_{i+1},\ \alpha_{i+2}\right)+$$

$$+\sum_{\alpha_{i-1}}F^{(3)}\left(\alpha_{i-1},\ \alpha'_i,\ \alpha_{i+1}\right)w_{\alpha'_i\to\alpha_i}\left(\alpha_{i-1},\ \alpha'_i,\ \alpha_i,\ \alpha_{i+1}\right)+$$

$$+\sum_{\alpha_{i+2}}F^{(3)}\left(\alpha_i,\ \alpha'_{i+1},\ \alpha_{i+2}\right)w_{\alpha'_{i+1}\to\alpha_{i+1}}\left(\alpha_i,\ \alpha'_{i+1},\ \alpha_{i+1},\ \alpha_{i+2}\right) \qquad (11)$$

и при $n \geq 3$

$$\frac{dF^{(n)}(\alpha_i,\ \alpha_{i+1},\ \dots \alpha_{i+n-1})}{dt}=-F^{(n)}\left(\alpha_i,\ \alpha_{i+1},\ \dots \alpha_{i+n-1}\right)$$

$$\sum_{p=1}^{n-2}w_{\alpha_{i+p}\to\alpha'_{i+p}}\left(\alpha_{i+p-1},\ \alpha_{i+p},\ \alpha'_{i+p},\ \alpha_{i+p+1}\right)-$$

$$-\sum_{\alpha_{i-1}}F^{(n+1)}\left(\alpha_{i-1},\ \alpha_i,\ \alpha_{i+1},\ \dots \alpha_{i+n-1}\right)w_{\alpha_i\to\alpha'_i}\left(\alpha_{i-1},\ \alpha_i,\ \alpha'_i,\ \alpha_{i+1}\right)-$$

$$-\sum_{\alpha_{i+n}}F^{(n+1)}\left(\alpha_i,\ \alpha_{i+1},\ \dots \alpha_{i+n-1},\ \alpha_{i+n}\right)w_{\alpha_{i+n-1}\to\alpha'_{i+n-1}}\left(\alpha_{i+n-2},\ \alpha_{i+n-1},\right.$$

Card 9/12

20118

The kinetics of cooperative ...

$$\alpha'_{i+n-1}, \ \alpha_{i+n}) + \sum_{p=1}^{n-2} F^{(n)}(\alpha_i, \ \alpha_{i+1}, \ \ldots \alpha_{i+p-1}, \ \alpha'_{i+p}, \ \alpha_{i+p+1}, \ \ldots, \ \alpha_{i+n-1}) \times$$

$$\times w_{\alpha'_{i+p} \to \alpha_{i+p}}(\alpha_{i+p-1}, \ \alpha'_{i+p}, \ \alpha_{i+p}, \ \alpha_{i+p+1}) + \sum_{\alpha_{i-1}} F^{(n+1)}(\alpha_{i-1}, \ \alpha'_i, \ \alpha_{i+1},$$

$$\ldots \alpha_{i+n-1}) w_{\alpha'_i \to \alpha_i}(\alpha_{i-1}, \ \alpha'_i, \ \alpha_i, \ \alpha_{i+1}) +$$

$$+ \sum_{\alpha_{i+n}} F^{(n+1)}(\alpha_i, \ \alpha_{i+1}, \ \ldots \alpha'_{i+n-1}, \ \alpha_{i+n}) \times$$

$$\times w_{\alpha'_{i+n-1} \to \alpha_{i+n-1}}(\alpha_{i+n-2}, \ \alpha'_{i+n-1}, \ \alpha_{i+n-1}, \ \alpha_{i+n}). \tag{12}$$

Card 10/12